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(56) Documents Cited

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(54) Abstract Title

A hinge assembly and a motor vehicle including the same

(57) A hinge assembly 10a, (110, figures 5 and 6) has a deformable member 17 (30, figures 5 and 6) to absorb energy when a load beyond a pre-determined level is applied to the hinge assembly. A frangible fixing 18 (32, figures 5 and 6) is arranged to fail so enabling the deformable member 17 (30, figures 5 and 6) to absorb energy and transfer load to the structure to which the hinge assembly is fastened.

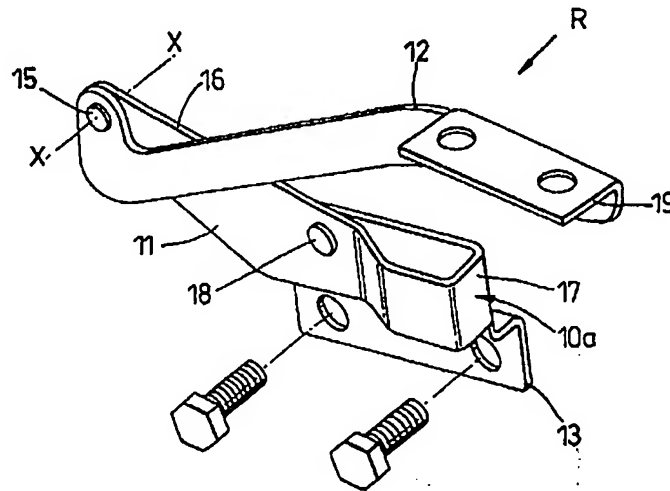


Fig. 2

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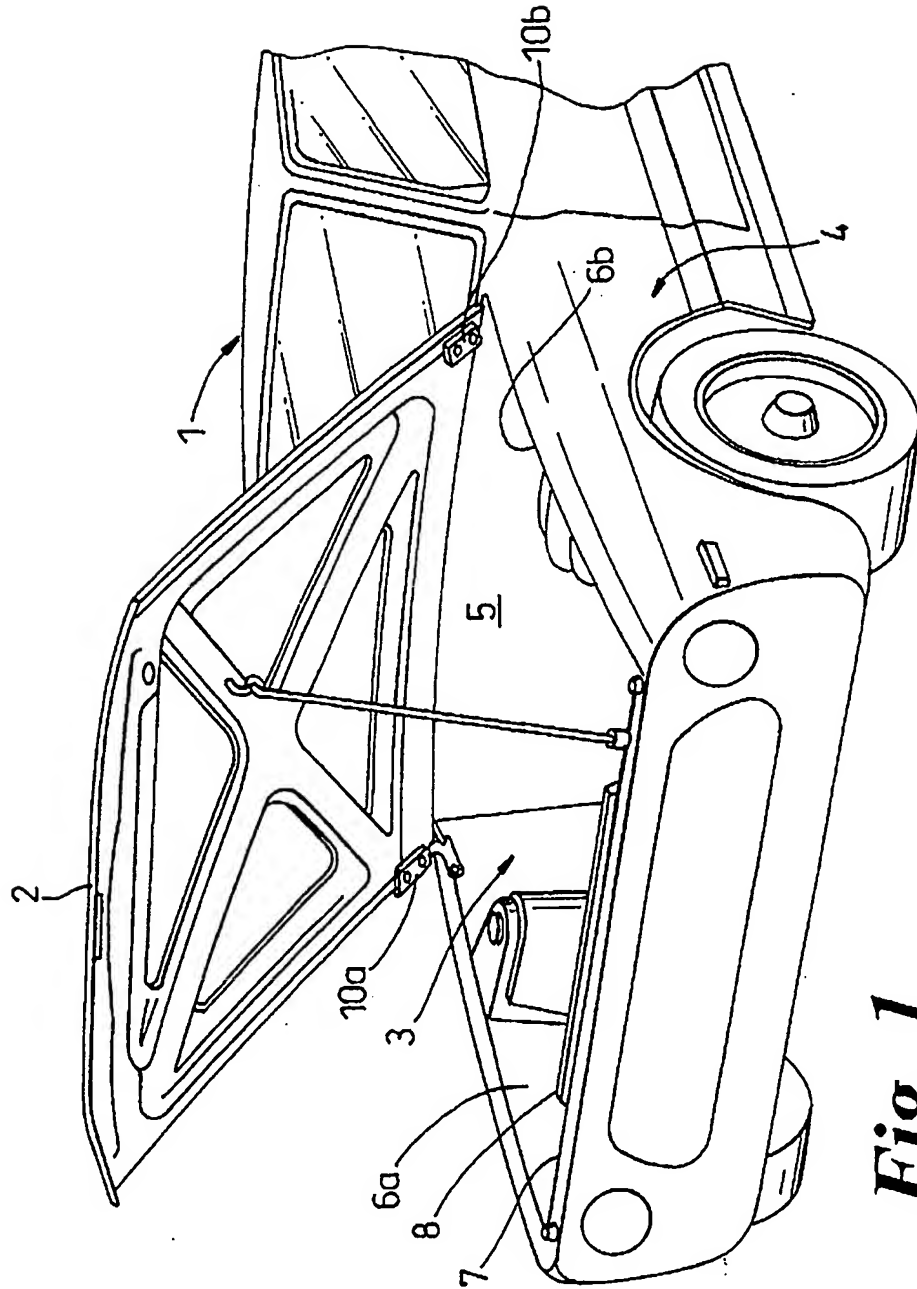


Fig. 1

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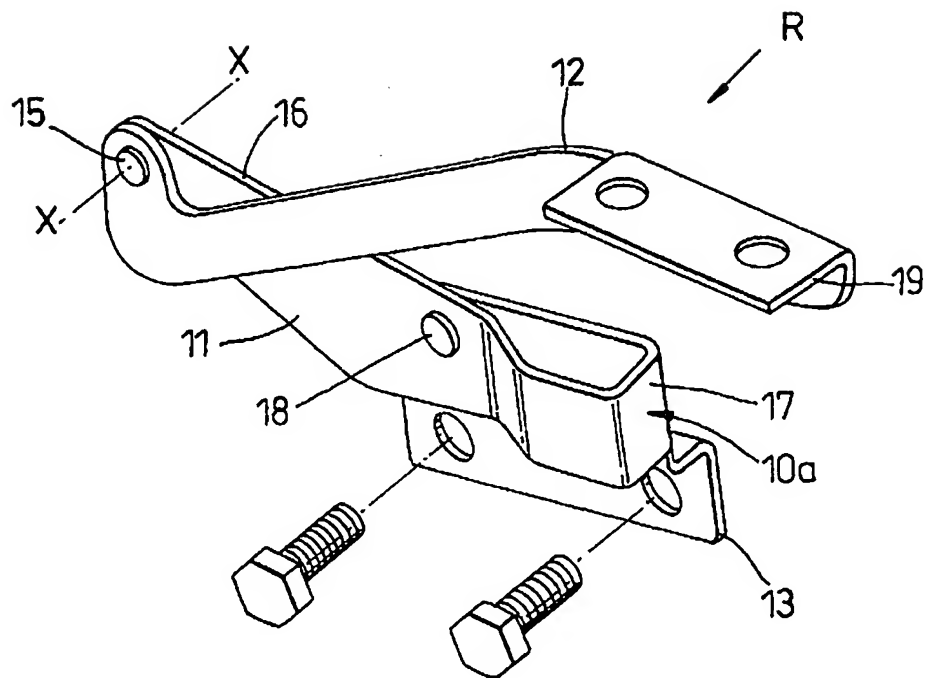


Fig. 2

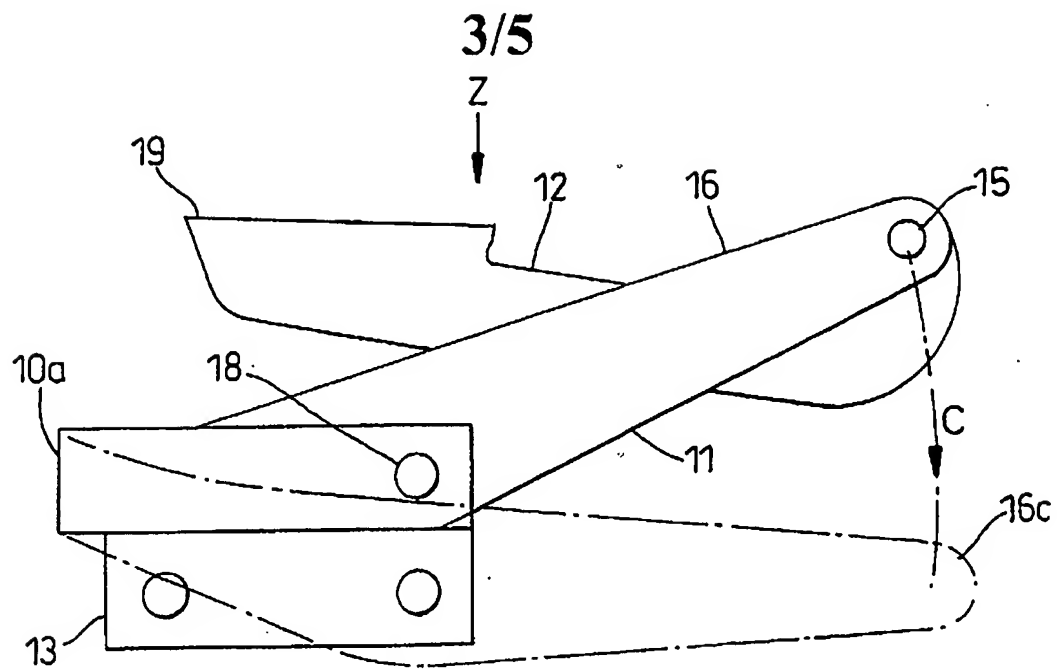


Fig. 3

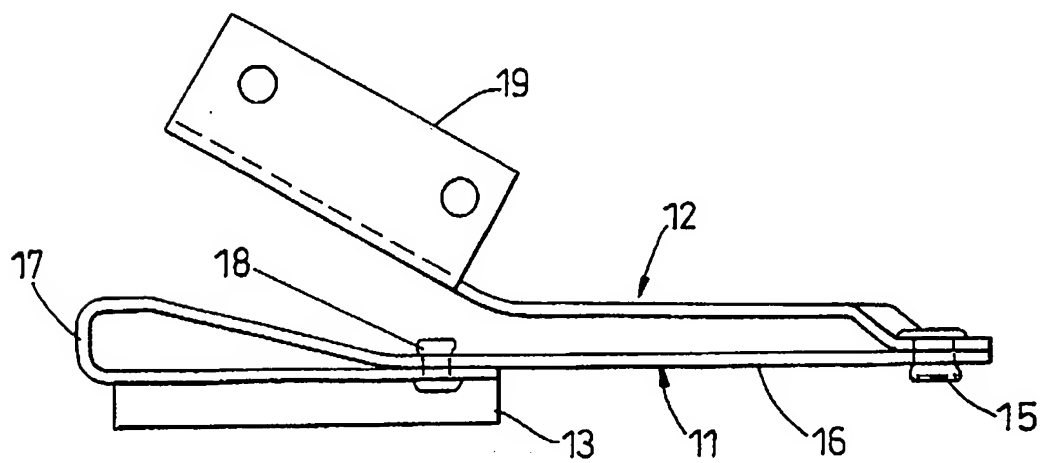


Fig. 4

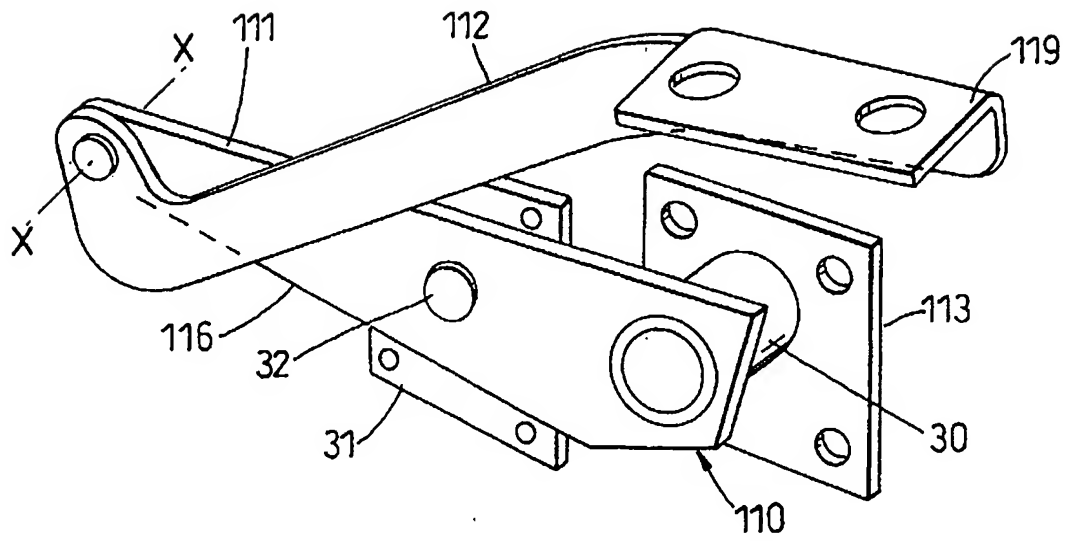


Fig. 5

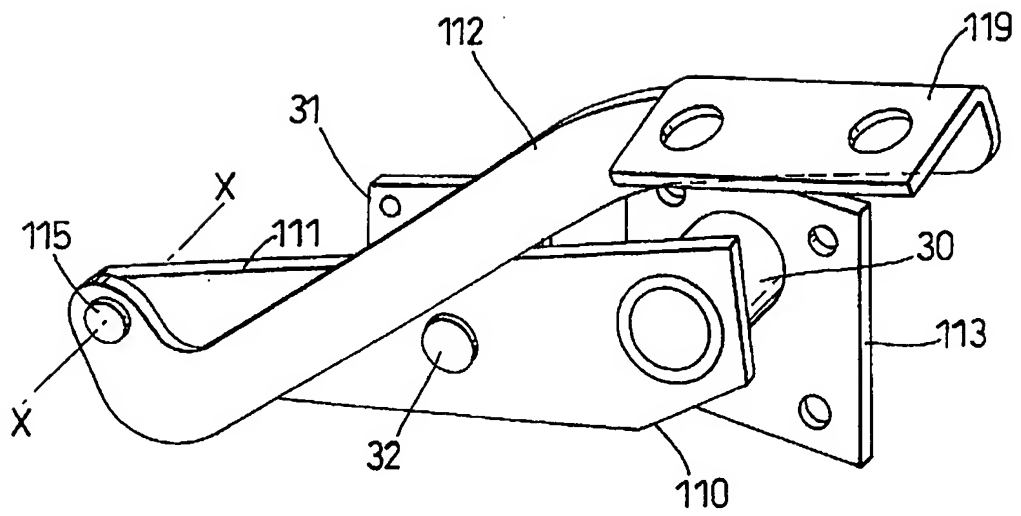


Fig. 6

A Hinge Assembly and a motor vehicle including same

This invention relates to a hinge assembly and in particular to a hinge assembly for a motor vehicle.

It is well known to pivotally connect a bonnet or hood to the body structure of a motor vehicle to allow access to an engine compartment of the motor vehicle. There are increasing demands for motor vehicles to be more pedestrian friendly in the event of a collision between a moving vehicle and a pedestrian. It is a particular problem that in the event of such a collision the pedestrian is often thrown onto the bonnet of the vehicle and can suffer head injuries if sufficient compliance is not provided in the bonnet structure.

Although the main structure of the bonnet is relatively compliant the hinge fixings for the bonnet represent hard points that offer little compliance if impacted against directly by the head of a pedestrian.

It is an object of the invention to provide a more compliant fixing means for a bonnet.

According to a first aspect of the invention there is provided a hinge assembly for pivotally connecting a body closure member to part of a body structure of a motor vehicle, the assembly comprising a first arm connected at a first end thereof to part of the body structure and a second arm connected at a first end thereof to the body closure member, the first and second arms being pivotally connected together at respective second ends thereof to form a hinge, wherein the first arm is connected to the body structure at said first end through a deformable member and is additionally secured to the body structure at a position between its first and second ends by a frangible securing means arranged to fail when a load greater than pre-determined load is applied to the first arm.

A portion of the first arm may form the deformable member, the deformable member being arranged to absorb energy after failure of the frangible securing means.

Advantageously, the deformable portion of the first arm lies substantially parallel to a pivot axis of the hinge.

The deformable member may be a separate component joining the first arm to the body structure.

The frangible securing means may be a shear pin.

According to a second aspect of the invention there is provided a motor vehicle having a bonnet pivotally connected to part of a body structure of the motor vehicle by at least one hinge assembly according to said first aspect of the invention.

The invention will now be described by way of example with reference to the accompanying drawing in which

- Fig.1 Is a pictorial representation of the front part of a motor vehicle according to a second aspect of the invention showing two hinge assemblies according to a first aspect of the invention;
- Fig.2 is a pictorial view of a first embodiment of a hinge assembly according to the first aspect of the invention;
- Fig.3 is a side view in the direction of arrow R on Fig.2 showing the hinge assembly in normal and collapsed positions;
- Fig.4 Is a plan view in the direction of arrow Z on Fig.3;
- Fig.5 is a pictorial view of a second embodiment of a hinge assembly according to the first aspect of the invention in a normal in use position; and
- Fig..6 is a pictorial view of a second embodiment of a hinge assembly according to the first aspect of the invention in a collapsed position.

With particular reference to Figs.1 to 4 there is shown a motor vehicle 1 having a body closure member in the form of a bonnet or hood 2 pivotally connected to part of a body structure 4 of the motor vehicle 1 by two hinge assemblies 10a, 10b. The bonnet 2 being movable between a closed position and an open position (as shown in Fig.1) to provide access to an engine compartment 3 of the motor vehicle. For ease of understanding no engine is shown in Fig.1 but in practice an engine would be mounted within the engine compartment 3. The engine compartment 3 is defined by a firewall 5 left and right inner wing panels 6a, 6b and a front wall 7 to which is attached a radiator 8 of the motor vehicle 1.

The firewall 5, left and right inner wing panels 6a, 6b and the front wall 7 are all parts of the overall body structure 4 of the motor vehicle 1.

As can best be seen with reference to Fig.2 each of the hinge assemblies 10a, 10b, of which assembly 10a is shown, comprises a first arm 11 and a second arm 12 pivotally connected together for relative motion therebetween about a pivot axis X-X.

The first arm 11 is connected at a first end thereof by means of a plate 13 to part of the body structure 4 in the form of the inner wing panel 6a. The plate 13 is fastened to the inner wing panel 6a by two threaded fasteners in the forms of bolts 14 which engage with complementary weld nuts (not shown) fixed to the inner wing panel 6a.

The first arm 11 is pivotally connected at a second end thereof to a second end of the second arm 12 by a pivot pin 15 and has an elongate portion 16 extending away from the position of pivotal connection. Near to its position of juncture to the plate 13 the elongate portion 16 is bent over to form a deformable member 17. The deformable member is formed by a deformable portion 17 of the first arm 11 and extends along an axis that is substantially parallel to the pivot axis X-X of the hinge assembly 10a.

The elongate portion 16 is secured to the plate 13 at a position between the deformable portion 17 and the second end of the first arm 11 by a frangible securing means in the form of a shear pin 18.

The second arm 12 is pivotally connected to the first arm 11 at its second end and has a first end in the form of a fixing plate 19 adapted for connection to the bonnet 2. The fixing plate 19 is formed by bending over an end portion of the second arm 12 and is secured to the bonnet 2 by threaded fasteners (not shown).

Operation of the hinge assembly is as follows. During normal use the first arm 11 remains stationary as is fixed to the inner wing panel 6a and the second arm 12 rotates relative to the first arm 11 to facilitate opening and closing of the bonnet 2.

In this condition the fixing plate 19 and the pivot axis X-X are both offset vertically upwardly from the plate 13. Any load transferred from the second arm 12 to the first arm 11 due to opening or closing of the bonnet 2 is transferred into the inner wing

panel 6a via the shear pin 18 to the plate 13 and hence to the inner wing panel 6a. During this mode of operation no load is transferred via the deformable portion 17 to the plate 13 and the shear pin 18 acts as a rigid connection between the first arm 11 and the plate 13.

If the motor vehicle 1 is involved in a collision with a pedestrian causing the pedestrian to be thrown on the bonnet 2 with sufficient force that the load transferred from the pedestrian to the first arm 11 exceeds a pre-determined level then the shear pin 18 will fail and the hinge assembly will collapse in a progressive manner.

When the shear pin 18 fails the first arm 11 is no longer able to transfer load to the plate 13 through this connection which causes the load to be transmitted via the deformable portion 17. The deformable portion 17 is designed to distort in a controlled manner so as to absorb energy and to allow the first arm 11 to move downwardly towards a new lower position (shown by arrow C and the dotted outline reference numeral 16c on Fig. 3).

Because of the interconnection between the first and second arms 11 and 12 the second arm 12 also moves to a lower position and this allows the bonnet 2 to move downwardly thereby absorbing some of the force of impact. In particular the rigid pivotal connection between the two arms 11 and 12 is moved downwardly thereby minimising the probability of contact between a body part and this joint.

In this way the risk of contact between a hard structural component and a body part is minimised but in addition because the bonnet 2 moves in the same direction as the pedestrian impacting upon the bonnet 2 the peak impact loads imparted to the pedestrian are reduced.

It will be appreciated that by varying the shape and dimensions of the deformable portion the collapse characteristics of the hinge assembly can be adjusted to suit the particular vehicle installation.

With particular reference to figs 5 and 6 there is shown a hinge assembly that in many respects is similar to that previously described and for which like parts will be given the same reference numerals with the addition of 100.

The hinge assembly 110 comprises a first arm 111 and a second arm 112 pivotally connected together for relative motion therebetween about a pivot axis X-X.

The first arm 111 is connected at a first end thereof by means of a plate 113 to part of the body structure of the motor vehicle. The plate 113 is fastened to the body structure by four threaded fasteners (not shown) which engage with complementary weld nuts (not shown) fixed to the body structure.

The first arm 111 is pivotally connected to a second end of the second arm 112 by a pivot pin 115 and has an elongate portion 116 extending away from the position of pivotal connection.

The elongate portion 116 of the arm 111 is connected to the plate 113 by a deformable member in the form of a thin walled tube 30. The tube 30 extends along an axis that is substantially parallel to the pivot axis X-X of the hinge assembly 110.

The elongate portion 116 is secured to a second plate 31 at a position between the deformable member 30 and the second end of the first arm 111 by a frangible securing means in the form of a spot weld 32. The second plate 31 is fastened to the body structure by four threaded fasteners (not shown) which engage with complementary weld nuts (not shown) fixed to the body structure.

The second arm 112 is pivotally connected to the first arm 111 at its second end and has a first end in the form of a fixing plate 119 adapted for connection to the bonnet 2. The fixing plate 119 is formed by bending over an end portion of the second arm 112 and is secured to the bonnet 2 by threaded fasteners (not shown).

Operation of the hinge assembly is as follows. During normal use the first arm 111 remains stationary and the second arm 112 rotates relative to the first arm 111 to facilitate opening and closing of the bonnet 2.

In this condition the fixing plate 119 and the pivot axis X-X are both offset vertically upward from the plate 113. Any loads transferred from the second arm 112 to the first arm 111 due to opening or closing of the bonnet 2 are transferred into the body structure via the spot weld 32 and second plate 31. During this mode of operation no

load is transferred via the tube 30 to the plate 113 and the spot weld 32 acts as a rigid connection between the first arm 111 and the body structure.

If the motor vehicle 1 is involved in a collision with a pedestrian causing the pedestrian to be thrown on the bonnet 2 then the hinge assembly 110 is arranged to fail in a progressive manner when the load transferred from the pedestrian to the spot weld 32 exceeds a pre-determined level.

When the load exceeds the pre-determined level the spot weld 32 fails and the first arm 111 is no longer able to transfer load to the plate 31 through this connection. This causes the load to be transmitted via the tube 30. The tube 30 is designed to distort in a controlled manner so as to absorb energy and to allow the first arm 111 to move downwardly towards to a new lower position (shown in Fig. 6). Because of the interconnection between the first and second arms 111 and 112 the second arm 112 also moves to a lower position. This downward motion allows the bonnet 2 to move downwardly thereby absorbing some of the force of impact. In particular the rigid pivotal connection between the two arms 111 and 112 is moved downwardly thereby minimising the probability of contact between a body part and this joint.

Although the invention has been described by way of example with reference to two specific embodiments it will be appreciated that alternative embodiments could be constructed without deviating from the invention. For example the spot weld or shear pin could be replaced by some other form of connection arranged to fail when a pre-determined load is applied and the deformable member could be formed by a member that undergoes bending rather than the torsional deformation described above.

Claims

1. A hinge assembly for pivotally connecting a body closure member to part of a body structure of a motor vehicle, the assembly comprising a first arm connected at a first end thereof to part of the body structure and a second arm connected at a first end thereof to the body closure member, the first and second arms being pivotally connected together at respective second ends thereof to form a hinge, wherein the first arm is connected to the body structure at said first end through a deformable member and is additionally secured to the body structure at a position between its first and second ends by a frangible securing means arranged to fail when a load greater than pre-determined load is applied to the first arm.
2. A hinge assembly as claimed in Claim 1 in which a portion of the first arm forms the deformable member, the deformable member being arranged to absorb energy after failure of the frangible securing means.
3. A hinge assembly as claimed in Claim 2 in which the deformable portion of the first arm lies substantially parallel to the pivot axis of the hinge.
4. A hinge assembly as claimed in Claim 1 in which the deformable member is a separate component joining the first arm to the body structure.
5. A hinge assembly as claimed in any preceding claim in which the frangible securing means is a shear pin.
6. A motor vehicle having a bonnet pivotally connected to part of a body structure of the motor vehicle by at least one hinge assembly as claimed in any of Claims 1 to 5.
7. A hinge assembly substantially as described herein with reference to the accompanying drawings.
8. A motor vehicle substantially as described herein with reference to the accompanying drawings.



Application No: GB 0103720.9
Claims searched: 1-8

Examiner: Sarah Harrison
Date of search: 20 April 2001

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): E2F (FAD & FPX)

Int Cl (Ed.7): E05D, B60R & B62D

Other: Online: EPODOC, WPI & JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	WO 0069704 (Edscha)	
A	DE 19922455 (Edscha)	
A	DE 19922454 (Edscha)	
A	JP 2000108842 (Mazda)	
A	JP 20006846 (Honda)	

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